



CAMOSUN COLLEGE
Trades and Technology
Electronics and Computer Engineering
ELEN 160
MICROCOMPUTER FUNDAMENTALS
Summer 2019
COURSE OUTLINE

The calendar description is available on the web @

Camosun.ca

IN-CLASS WORKLOAD:

5 lecture, 2 lab hrs/wk

OUT-OF-CLASS WORKLOAD:

7 hrs/wk

Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

1. Instructor Information

(a) Instructor	Justin Curran
(b) Office hours	Open Door and by Appointment
(c) Location	TEC 216A
(d) Phone	250-370-4432 Alternative: _____
(e) E-mail	jcurran@camosun.bc.ca
(f) Website	www.elex.camosun.bc.ca

2. Intended Learning Outcomes

Microcomputer Fundamentals introduces microcomputer hardware and software concepts, emphasizing the 68000 microprocessor and associated devices. Topics include general microprocessor characteristics, assembly programming basics including conditional branching, looping, and subroutines, microprocessor hardware, exception processing, semiconductor memory systems, 68000 I/O interfacing, and software / hardware troubleshooting.

Upon successful completion of this course a student will be able to:

- describe basic microcomputer concepts;
- practice with binary and hexadecimal data formats and data codes;
- recall the process of assembling, linking, and downloading software to a 68000-target system;
- generate short diagnostic programs in assembly language;
- describe exception processing and interrupt handling for the 68000 microprocessor;
- explain 68000 microprocessor architecture and the components involved in constructing microcomputer systems;
- summarize 68000 pin descriptions and functions for interfacing;
- recognize semiconductor memory types and systems;
- calculate memory addresses using memory decoding techniques;
- identify semiconductor memory interface circuits;
- describe basic microprocessor interfacing for serial and parallel data transfers, and compare polled, DMA, and interrupt I/O;
- explain the operation and programming of the 68230 parallel interface / timer IC;
- be able to interact with diagnostic software and test equipment including oscilloscopes and logic analyzers; and
- apply basic troubleshooting tools and diagnostic software.

3. Required Materials

- a. Access to Camosun D2L online course materials
- b. Other Reference: Motorola **M68000 Instruction Set (Provided as per requirement)**
- c. Handouts (will be distributed as required)
- d. Student File Share: \\elexsrv1\elexpub\elen 160 or \\142.31.204.249\elexpub\elen 160

4. Course Content (Total Lecture Hours 14 * 5 = 70)

Start Week 1 (Lec 5 hrs)

0. Course Introduction

1. Computer Concepts

- 1.1 Introduction
 - 1.1.1 History of Computers
 - 1.1.2 Types of Computers
 - 1.1.3 Computers Applications and Languages
- 1.2 Elements of a Microprocessor System
 - 1.2.1 Basic Block Diagrams
 - 1.2.2 Overview of Operation
 - 1.2.3 Overview of Operation
- 1.3 Microcomputer Buses
 - 1.3.1 Tristate: Interfaces
 - 1.3.2 Bidirectional Data Transfer

- 1.4 Programmers Models
 - 1.4.1 Introduction to HEXADECIMAL Numbers
Any spares times is used for prelab/labprep

End of Week 1 (Lec 5 hrs)

Start Week 2 (Lec 5 hrs)

- 1.4 Programmers Models (cont...)
 - 1.4.2 Typical Internal Structure
 - 1.4.3 Execution of a Machine Language Program
 - 1.4.4 CPU Model - M68000 Internal Registers
 - 1.4.5 Memory Model
 - 1.4.6 Data Models
2. Programming I
 - 2.1 Number Systems Review
 - 2.1.1 Decimal/Binary and Binary/Decimal Conversions
 - 2.1.2 Addition and Subtraction in Binary
 - 2.1.3 Signed numbers and Two's Complement
 - 2.1.4 ASCII Character Set
 - 2.1.5 Overview of Parity

Any spares times is used for prelab/labprep

End of Week 2 (Lec 5 hrs)

Start Week 3 (Lec 5 hrs)

- 2.2 Microprocessor Software Principles
 - 2.2.1 Instruction Execution and Instruction set
 - 2.2.2 Mnemonic Representation/textual format
 - 2.2.3 Introduction to Addressing Modes
 - 2.2.4 Interpreting the Data Book (Hand Assembly)
 - 2.2.5 Simple Programs (Sequence Only)

Any spares times is used for prelab/labprep

End of Week 3 (Lec 5 hrs)

Start of Week 4,5,6,7 (Lec 5 hrs x 4 = 20)

3. Programming II
 - 3.1 Program fragments with conditional branches (1 week)
 - 3.2 Program fragments with loops (1 week)
 - 3.3 Program fragments with subroutines (1 and ½ week)

Tutorials and exercises (1 hr review for TT1) (1/2 week)

Any spares times is used for prelab/labprep

End of Week 4,5,6,7 (Lec 5 hrs x 4 = 20)

Start of Week 8 (Lec 3 hrs + 2hr TT1)

4. Exception Handling
 - 4.1 User/Supervisor Concepts
 - 4.2 MC68000 Exceptions
 - 4.3 MC68000 Reset Sequence
 - 4.4 Exception Vectors
 - 4.5 Exception Processing
 - 4.6 Interrupts and Interrupt Processing

(Start 3hr)

(2 hr TT1)

Any spares times is used for prelab/labprep

End of Week 8 (Lec 5 hrs)

Start of Week 9 (Lec 5 hrs)

5. Microprocessor Hardware I
 - 5.1 M68000 Pins and Signals
 - 5.2 Introduction to Timing Diagrams
 - 5.3 Bus Cycles
 - 5.3.1 Synchronous
 - 5.3.2 Asynchronous
 - 5.4 The M68000 Read Cycle
 - 5.4.1 Read Cycle Protocol
 - 5.4.2 Read Cycle Timing Diagram
 - 5.4.3 Introduction of Wait States
 - 5.5 The M68000 Write Cycle
 - 5.5.1 Write Cycle Protocol
 - 5.5.2 Write Cycle Timing Diagram

Any spares times is used for prelab/labprep

End of Week 9 (Lec 5 hrs)

Start Week 10 (Lec 8hrs + 2hr TT2 Review)

6. Microprocessor Hardware II (Memory Systems)
 - 6.1 Overview of Solid State Memory Devices
 - 6.2 Address Space
 - 6.3 The Static RAM
 - 6.3.1 SRAM Pin Functions
 - 6.3.2 SRAM Timing Diagrams
 - 6.4 A Basic Memory Interface
 - 6.5 Address Decoding
 - 6.5.1 Decoders
 - 6.5.2 Memory Maps/Memory Map Listings

- 6.5.3 Address Decoding Tables
- 6.5.4 Complete (Full) Address Decoding
- 6.5.5 Partial Address Decoding
- 6.5.6 Block Decoding
- 6.5.7 Examples
- 6.6 DTACK* Generation in a 68000 System
- 6.7 Error Detection and Correction
- 6.8 Memory Management Concepts

(Review 2hr for TT2)

Any spares times is used for prelab/labprep

End of Week 10 (Lec 8hrs + 2hr TT2 Review)

Start of Week 11 (Lec 3hr + 2hr TT2)

(Lec 3hr)

- 7. **Input / Output Interfaces**
 - 7.1 I/O Mapping
 - 7.2 Synchronization and Data Transfer
 - 7.3 Polling
 - 7.4 DMA
 - 7.5 Interrupt I/O

(2 hr TT1)

End of Week 11 (Lec 3hr + 2hr TT2)

Start of Week 12 (Lec 5hr)

- 8. **The Parallel I/O Interface**
 - 8.1 Concepts and Definitions
 - 8.2 The I/O Interface
 - 8.2.1 Basic Input Port
 - 8.2.2 Basic Output Port
 - 8.3 Electrical Considerations and Handshaking
 - 8.4 Interfacing the 68230 Parallel Interface / Timer
 - 8.5 IEEE 488 Bus

End of Week 12 (Lec 5hr)

Start Week 13 (Lec 5hr)

- 9. **The Serial I/O Interface**
 - 9.1 Asynchronous Serial I/O Basics
 - 9.2 RS-232C Standards
 - 9.3 6850 Serial Interface
 - 9.4 68681 Dual Asynchronous Universal Receiver Transmitter (DUART) Interface

End Week 13 (Lec 5hr)

Start Week 14 (Lec 3hr + 2 hr review)

Lec 3hr

- 10. **Development and Debugging Tools**
 - 10.1 Microprocessor Development Systems
 - 10.2 The Logic Analyzer
 - 10.3 Diagnostic and Troubleshooting Tools

(Final Review 2hr)

End Week 14 (Lec 3hr + 2 hr review)

Lab Exercises

Schedule may change based on timing or component availability.

Week 1

- Lab 1 – Introduction to Microprocessor Lab
- Introduction to 68000 Registers and Memory

Week 2

- Lab 2 – Programmer's Reference Exercise
- Addressing Modes

Week 3

- Lab 3 – Introduction to 68K Training Board
- Introduction to Programming Tools

Week 4

- Lab 4 – Simple Programs – Selection

Week 5

- Lab 5 – Simple Programs – Looping

Week 6

- Lab 6 – Simple Programs - Subroutines

Week 7

- Lab 7 – Simple Programs - Exceptions
- Simple Programs – Graphics Exceptions

Week 8

- Lab 8 – Introduction to Application Board
- Simple Programs – Interfacing

Week 9

- Lab 9 – Application Board Programming - Multiplexing

Week 10

- Lab 10 – Application Board Programming - Parallel I/O
- Application Board Programming – Keypad

Week 11

Week 12

Week 13

Week 14

- Lab 11 – Logic Analyzer –Lab
- Course Review

5. Basis of Student Assessment (Weighting)

(a) Assignments / Quizzes	=	20%
(b) Mid-term Test 1	=	15%
(c) Mid-term Test 2	=	15%
(d) Labs	=	10%
(e) Final Exam	=	40%
Total	=	100%

Attendance is required for all classroom, lab, and D2L activities. It is the student's responsibility to communicate with the instructor, preferably prior to any absence. Any absence not sufficiently justified will result in a loss of 5% of the overall course grade.

Professionalism: "the skill, good judgment, and polite behavior that is expected from a person who is trained to do a job well" (Merriam Webster online). Students will be evaluated on the above as well as their ability to work well in a team.

Assignments and/or Quiz are based on the lecture topics and hands on lab exercises – Quizzes will occur towards the ending of lab or class period.

You are encouraged to use the D2L discussion area to ask questions as this will be monitored by the instructor.

Laboratory evaluation is based on the following criteria:

- 1/2 mark is given for attendance, cleanliness, deportment, group work, equipment treatment of your lab grade for each lab period.
- 1/2 mark is given for completion of lab activities based on demonstration and/or journal work of your lab grade for each lab period.

You need to keep a journal for any information relating to this course such as terminology, lab exercises, observations, and procedures.

Please note the following:

1. A grade of 60% or better is required in all assignments, quizzes and term-test to be able to pass the course.
2. A grade of 50% or better is required in the final examination to be able to pass the course.
3. No late materials will be accepted past midnight of the last day of the course.
4. A student is required to inform the instructor prior to being late or missing a class, or as soon as possible.

6. Grading System

Standard Grading System (GPA)

Competency Based Grading System

7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Student Services or the College web site at <http://www.camosun.bc.ca>

STUDENT CONDUCT POLICY

There is a Student Conduct Policy. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, Registration, and on the College web site in the Policy Section.
<http://www.camosun.bc.ca/policies/policies.html>

A. GRADING SYSTEMS <http://www.camosun.bc.ca/policies/policies.php>

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at

<http://www.camosun.bc.ca/policies/E-1.5.pdf> for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.